

Zero Retries issue 0056 2022-07-21

Zero Retries is a unique, quirky little highly independent, opinionated, self-published email newsletter about technological innovation in Amateur Radio, for a self-selecting niche audience, that's free (as in beer) to subscribe.

About Zero Retries

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Request To Send

Countdown to [Digital Communications Conference 2022](#) - September 16-18, in Charlotte, North Carolina, USA:

~~10 09 08~~ weeks...

Countdown to DCC 2022 Paper submission deadline - September 1:

~~~08 ~07 ~06~~ weeks...

It was the best of times, it was the worst of times...

[Charles Dickens, A Tale of Two Cities](#)

I've periodically explained that Zero Retries exists, in part, to "scratch my own itch" for

reading “Zero Retries Interesting” material about what I consider the cool stuff in Amateur Radio - *technological innovation in Amateur Radio*, especially operating in the microwave frequencies above 1 GHz, space / satellite communications, and data communications including (but not limited to) packet radio. If I could just “sit back and read about it”... *I would* just “sit back and *read about it*”. In truth, I’m much more a reader and learner, than a writer.

That perspective was brought into stark relief in the past week with the confluence of three events.

First was the arrival of an eBay notification. I have an eBay keyword search for “Azden PCS-9600D”. The [PCS-9600D](#) was one of the *best* Amateur Radio *data* radio ever developed to date. What eBay was actually informing me about was the availability of a copy of the **May, 1995 issue of QST**, which featured a review of the PCS-9600D.

Second was the arrival of the (paper) issue of the August 2022 issue of QST. In that issue, the new Yaesu FTM-6000R was reviewed by Rick Palm K1CE.

Third, I have the May, 1995 issue of QST in my archives, so I was able to quickly grab it and reread it.

From the Dickens quote, the “best of times” is that Amateur Radio has never before had more access to incredible technology to have more fun, to accomplish more interesting things, than *now*.

The “worst of times” is that Amateur Radio has, from most appearances, lost much of its former spirit of experimentation and technological innovation, especially the use of digital and data technologies. In short, we’ve *devolved*, *at least if you judge from “the mainstream media” of Amateur Radio’s lack of mentions of digital and data technologies*.

Case in point - The May 1995 QST devoted almost *two pages* to review the Azden PCS-9600D, a radio developed entirely for data use. (There were ten *other* Zero Retries Interesting pieces in that issue, but for space issues, that discussion had to be pushed to a future issue.) If you’re an ARRL member, you can [download the review](#) of the PCS-9600D in the May, 1995 issue of QST, pages 78-79, by Steve Ford W8IMY.

Fast forward 27 *years*, and in the August 2022 issue of QST (Page 39), Rick Palm K1CE reviews the Yaesu FTM-6000R VHF/UHF Mobile Transceiver for *five pages* (in the printed version of QST). As I wrote in **Zero Retries 0017** - New Yaesu FTM-6000R “Data” Radio, in my opinion, the primary feature of the FTM-6000R is the inclusion of a “data jack”. All of the other features of the FTM-6000R are matched or exceeded by other new VHF / UHF radios. But in a *new* radio that was released in 2022, no other manufacturer had included a “data jack”. Thus, in my mind, that “data jack” is *significant*. But, K1CE devotes but *one sentence* to that feature (out of *five pages*):

Additionally, a 10-pin data port on the rear panel allows connection of a terminal node controller (TNC) for packet operation.

*That* is what passes for “Zero Retries Interesting” information *in QST in 2022*. That, and Steve Ford WB8IMY’s “Eclectic Technology” column on Page 51, which this month discussed the

use of a USB-connected GPS receiver puck - **“Keeping Time Outdoors”**. In contrast to Eclectic Technology (which is never permitted more than one page), the **A Look Back** feature, which reminisces about the September 1972 issue of QST, merits *6 pages, including two full-page ads of defunct companies. Thank goodness for WB8IMY* maintaining at least a tiny bit of Zero Retries Interesting content in QST.

Thus, the existence of Zero Retries. ‘Nuff said.

de Steve N8GNJ

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## **Correction on Mentions of Multimode Digital Voice Modem (MMDVM)’s Capabilities and Operation**

In Zero Retries 0055, I said:

As I understand it, MMDVM can operate *all* of these modes, it can switch between them, and there can even be transcoders to convert one DV mode to another. But, it can only operate one DV mode at a time...

Perhaps it’s time to try to incorporate MMDVM’s ability to operate all the Amateur Radio Digital Voice modes into a “polyglot” radio? Eventually we’ll have powerful enough processors to enable MMDVM to automagically deal with all the Digital Voice modes, “on the fly”, perhaps with a default to M17. If someone uses, for example, DMR, the MMDVM radio will instantly recognize DMR and switch to that mode for the duration of the conversation. Etc.

**Jonathan Naylor G4KLX** replied with this detailed note via email:

I need to correct you a little about the MMDVM and its operation, as its creator I think I can speak with authority about it.

With the hotspot hat version, each mode is tested for in sequence. This limitation is a consequence of the chip used, the [ADF7021](#). Each mode has different waveform characteristics and needs the chip to be reprogrammed for each mode, hence the dancing lights.

For the modem based version, things are much simpler. Unless the system is being used by a particular mode already, then the modem listens on all enabled modes simultaneously. Therefore no mode gets precedence, and of course you can disable unwanted modes anyway to save some processing power.

With G4KLX’s input, I see two things I stated incorrectly.

- *As I understand it, MMDVM can operate all of these modes, it can switch between them, and there can even be transcoders to convert one DV mode to another.*

Stated more correctly:

MMDVM can operate *all* of these modes, but only one at a time as each mode is tested for in sequence and the mode being received is identified. “Transcoders” can “translate”

one DV mode to another, but that capability is external to MMDVM and is typically done “on the network”.

- *Perhaps it's time to try to incorporate MMDVM's...*

Rewriting that paragraph to address that this imagined capability already exists:

If you want a “universal” Digital Voice radio - one radio that can operate all Digital Voice modes (including M17), that capability exists now by marrying an MMDVM to a conventional radio with “flat audio” connections.

## Amateur Radio Digital Voice - Part 2

*Continued from Amateur Radio Digital Voice - Part 1 in Zero Retries 0055.*

An alternative to Module 17 is Mobilinkd's [Nucleo TNC](#) project, which supports M17.

The Nucleo TNC is a breadboard implementation of the Mobilinkd TNC3 using a STM32L432KC Nucleo32 board. This TNC faithfully implements the audio section and EEPROM storage of the TNC3. It omits the battery charging and Bluetooth components of the TNC3. It presents as a KISS TNC over a USB serial port.

Mobilinkd offers a case and a [printed circuit board](#) for Nucleo TNC, but the problem is, of course, obtaining the components, most notably the Nucleo32-L432KC module that is the core of the Nucleo TNC.

Lastly, there is the [Mobilinkd TNC3](#) - a turnkey (no building, other than cables) packet radio TNC for portable radio use that also supports M17. Currently the TNC3 is also unobtainium, but this mention on the TNC3 product page offers some hope:

SOLD OUT -- due to high demand and the global chip shortage, the TNC3 is sold out for the foreseeable future. At this point the earliest we expect to have more available is September 2022. We are not accepting back-orders.

Thus, while M17 seems to be a potential solution for Open Source Digital Voice in Amateur Radio (or, as K0NR posited, *Universal Digital Voice*), and they're making progress, M17 (and OpenRTX) still seem a long way from being viable options for Amateur Radio even for those of us who are willing to pay for experimental units such as Module 17 and accept some “lack of refinement”.

A few other observations about M17:

- Another approach to “prove out” M17 might be to create M17 implementations for Software Defined Receivers and Transceivers. A LimeSDR Mini 2 is \$399. To be able to receive M17, perhaps another implementation for a \$100 or so Software Defined Receiver might be appropriate to be able to listen full time for M17 transmissions. I was going to suggest that implementing M17 in GNU Radio might be an interesting project, but apparently [such a project is already underway](#).
- In April, 2021 M17 Project received an [ARDC grant for \\$250k](#) with Open Research

Institute as their fiscal sponsor. It's now been more than one year since that grant, and I look forward to reading a (public) progress report of the results M17 has been able to accomplish with their ARDC grant.

My conclusion is that, like a lot of technologies available to Amateur Radio, what's preventing M17 Project's technologies from at least experimental adoption isn't the technology, it's the lack of widespread recognition and promotion (evangelism). That, and there aren't any plug and play solutions that you can buy off the shelf - there's no M17 Radio (unless you count FlexRadio). As far as evangelism, there's some progress on that front such as Ed Wilson N2XDD promoting M17 at the [HamOpen.org](https://www.hamopen.org/) booth at Hamvention 2022. There needs to be a lot more of that. I'll try to do my part here in Zero Retries to cover the progress of the M17 Project.

...

I now have two identified paths for my personal experimentation with M17:

- I've ordered a [ZUM Radio MMDVM-Pi Board](#) from Ham Radio Outlet in the US. It will be interesting to try to configure it for use with M17.
- As soon as it becomes available again, I plan to order a [Mobilinkd TNC3](#), which has solid support for M17 having worked with the M17 developers.

### **An Update on MMDVM's Support for M17 from (MMDVM creator) Jonathan Naylor G4KLX:**

Regarding M17 operation, as well as the MMDVM which currently supports the mode along with an Internet gateway with voice prompts, echo server, etc. There is also my [M17 Client](#). This allows you to use an MMDVM system, hotspot or modem, and a computer (typically a Pi) and a USB headset, you can have a full M17 RF system. Indeed the first M17 RF to RF QSO via a reflector was made by myself and M0IEI last summer. You can control the M17 Client either via a conventional GUI or a touch screen interface. The development of the M17 Client was helped by the ORI.

So, if I understand G4KLX correctly, an M17 system for communicating via radio can consist of:

- MMDVM unit such as the MMDVM-Pi Board
- Raspberry Pi
- Speaker / Microphone / Headset
- Display, keyboard, etc. for configuring the MMDVM
- Radio with a flat audio connection (data jack) such as the Yaesu FTM-6000D or Kenwood TM-V71A.

- Patience 😊

Lastly...

***Congratulations Wojciech! It's an honor richly deserved!***

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## FreeDV - Open Source Digital Voice

In researching the above article about M17 Project, I discovered the website [FREEDV: OPEN SOURCE AMATEUR DIGITAL VOICE](#) - *Where Amateur Radio Is Driving The State of the Art*, and the mature applications software available there for using FreeDV. While Codec 2 is the actual CODEC - analog voice to digital modulation, and digital modulation to analog voice, there's much more required for communications over radio than just the CODEC.

As I understand it (not having experimented with FreeDV yet), FreeDV software on a host computer acts like a modem on an existing radio. Microphone and speakers are on the computer, the computer is connected to the radio, and just like a data modem, the software running on the computer does most of the work. Thus if you want to experiment with Open Source Digital Voice now, FreeDV is available for use, *and usable now*.

What especially intrigues me about using FreeDV is that there are now two projects underway to use the Codec 2 technology for *data* instead of voice. Since those two projects are “stuffing *data* into Codec 2 instead of digitized voice”, it may be possible that in FreeDV, data and voice can be interoperable. Want to chat with your buddy? Select *voice* in FreeDV. Want to send your buddy a text message or file? Select *data* in FreeDV.

I discussed these two projects in Zero Retries 0054. Quick links:

- **David Rowe VK5DGR** - Codec 2 HF Data Modes [Part 1](#), [Part 2](#), and [Part 3](#).
- **Simon Lang DJ2LS** - [FreeDATA](#)

For my personal interest - being able to experimentally chat, and exchange data on a water hole frequency with a buddy using Open Source Digital Voice implementation, if VK5DGR and/or DJ2LS succeed in “hacking” Codec 2 for data, FreeDV might be a good enough implementation rather than waiting for “the big project” that is M17 Project, to get enough momentum to be widely usable.

**Update:** Found in passing while researching another article - if you want to experiment with FreeDV at minimal expense, and have a spare Raspberry Pi computer, [FreeDV is one of the supported modes](#) of the amazing Software Defined Transmitter software [F5OEO/rpitx](#). There's also a provision for using “[Rpitx and low cost RTL-SDR dongle](#)”

**rtlmenu** allows to use rtl-sdr receiver dongle and **rpitx** together. This combine receiver and transmission for experimenting.

Amateur Radio is literally a license to experiment with radio technology!

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## ZR > BEACON

- [Digital Radio Research Group \(D2RG\)](#) - I found mention of this group during my research into MMDVM in relation to Digital Voice modes. Bruce Given VE2GZI [wrote](#): *Myself and two well [known] other Hams have formed a co-operative group. We call it Digital Radio Research Group or D2RG, [and] we want to do things differently moving forward. First product to launch will be the beginning of a Hotspot family. The first will be a full sized MMDVM\_HS Raspberry Pi Hat made in North America. It will be cost competitive. This will be followed by what we consider the logical extension to Hotspots. This group was formed in late 2018 or early 2019, but the web page still says Unfortunately, we're not quite ready yet.*

- [Reverse-engineering the Apollo spacecraft's FM radio](#)

*How did NASA communicate with the Apollo astronauts, hundreds of thousands of miles from Earth? The premodulation processor [1](#) (below) was the heart of the communication system onboard the Apollo spacecraft. Its multiple functions included an FM radio for communication to the astronauts, implemented by the Voice Detector, the module second from the top. In this blog post, I reverse-engineer the circuitry for that module and explain how it worked.*

- Hackaday held a [DIGITAL HAM HACK CHAT](#) on 2022-07-13 moderated by Dan Maloney N7DPM, with guests from ARDC - Executive Director Rosy Schechter KJ7RYV and Outreach Manager John Hays K7VE. The (text) chat went on for about one hour, and an interesting article resulted from the chat - [HELPING SECURE AMATEUR RADIO'S DIGITAL FUTURE](#) by Tom Nardi, Hackaday's Managing Editor.

*The average person's perception of a ham radio operator, assuming they even know what that means, is more than likely some graybeard huddled over the knobs of a war-surplus transmitter in the wee small hours of the morning. It's a mental image that, admittedly, isn't entirely off the mark in some cases. But it's also a gross over-simplification, and a generalization that isn't doing the hobby any favors when it comes to bringing in new blood.*

*In reality, a modern ham's toolkit includes a wide array of technologies that are about as far away from your grandfather's kit-built rig as could be — and there's exciting new protocols and tools on the horizon. To ensure a bright future for amateur radio, these technologies need to be nurtured the word needs to be spread about what they can do. Along the way, we'll also need to push back against stereotypes that can hinder younger operators from signing on.*

One of the reasons I really like Hackaday is that they see the utility of Amateur Radio as “wireless experimentation” for their techie audience and present it in a way that's relevant to their audience. This article is no exception, and well worth the read. The comments (most from non-Amateur Radio Operators [my perception]) are also interesting.

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## Feedback Loop

**Bill Dornbush AA6BD** re: Amateur Radio Digital Voice - Part 1 - in comments on Zero

Retries 0055:

Steve, although it would be nice if all of the digital voice flavors could communicate through a hotspot, this has some decided quirks, particularly when you get to Yaesu System Fusion. I believe that I understand the variants involved and have tried to explain: Yaesu System Fusion consists of a set of technologies, some of which are proprietary and others are not. These technologies are often used interchangeably, but they are not.

Bill's comments run 8 additional paragraphs. He followed up with this summary:

A short version: If you want to use a hotspot to reach Yaesu System Fusion Wires-X Rooms, you must connect to a YSF reflector that is bridged to the Yaesu Wires-X Room you want to communicate with. You cannot connect to a Room using only a hotspot.

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## Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out **Join the Fun on Amateur Radio** for some pointers.

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## Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with wireless technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing *Thanks* to:

- Tina Stroh KD7WSF for, well, *everything*!
- Pseudostaffer [Dan Romanchik KB6NU](#) for continuing to spot, and write about “Zero Retries Interesting” items on his blog that I don’t spot on my own.
- [Southgate Amateur Radio News](#) consistently surfaces “Zero Retries Interesting” stories.
- The [Substack email publishing platform](#) makes Zero Retries possible. I recommend it for publishing newsletters.

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More bits from Steve Stroh N8GNJ:

- [SuperPacket blog](#) - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- [N8GNJ blog](#) - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!

Steve Stroh N8GNJ / WRPS598 (He / Him / His)

These bits were handcrafted in beautiful Bellingham, Washington, USA

2022-07-22

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